← Contents

Chapter 2. PROPOSED ACTION AND ALTERNATIVES

The "Proposed Action," which is VELCO's preferred alternative, and other alternatives, including the "No Action Alternative," are discussed in the following sections.

2.1 Proposed Action

The Proposed Action, which is the applicant's preferred alternative, is to amend the Presidential Permit to be issued for the Derby Interconnection Facilities (now subject to PP-66-1) and, as agent for the HJO, to amend PP-82, as follows:

VELCO has applied to amend the first permit to authorize it to change operation of the Derby Interconnection Facilities as part of the Northern Loop Project. The change would reduce peak imports from TransEnergie in Québec[10] over the Derby Interconnection Facilities so that certain of the transmission facilities now used to transmit part of the imported energy to Highgate, Vermont, instead may be used to electrically connect or "loop" facilities operated by VELCO in northeastern Vermont (terminating at its Irasburg Substation) to facilities operated by VELCO in northwestern Vermont (terminating at its Highgate Substation).

The second amendment would increase imports under PP-82 to 250 MW. This would allow VELCO to import energy from Hydro-Québec to serve the Northwest Load without affecting (and potentially increasing) flows through the Highgate Converter Station, even though the now-

[10] TransEnergie is the transmission division of Hydro-Québec.

looped, Mosher's Tap-Highgate line, currently used to feed the Northwest Load, can no longer be synchronized to the Hydro-Québec system at Derby Line to supply that load.

2.1.1 Proposed Route

Irasburg to Mosher's Tap

VELCO proposes to co-locate the new 115-kV circuit with the former Citizens 48-kV circuit (now owned by VELCO) on single-pole structures and thus would rebuild the existing 6.47-mile, 48-kV transmission line with a 115-kV/48-kV line using double-circuit construction.

The new line is designed for wood or laminated-wood poles and for single, Corten™-steel poles in certain locations, which are rust-inducing poles that, once the color conversion has taken place, according to VELCO would blend well with the dark green of conifers and the brown of deciduous trees in winter.

The new line would be rebuilt approximately pole-for-pole along the alignment of the existing 48-kV line (see orthophotos in Appendix C) except where impacts on identified sensitive areas (wetlands and/or archaeological areas, identified on the Survey provided in Appendix C) would be minimized with selective placement of new poles.

VELCO states that it would construct the new line in accordance with the conditions set forth in the Vermont Agency of Natural Resources' Conditional Use Determination #2003-062 (see Appendix B). If, in the course of final design of this line, any pole relocation is found to be desirable for any reason, VELCO would be required under that ANR permit to notify the Vermont Wetlands Office in writing and to obtain written approval before proceeding. VELCO would also be subject to U.S. Army Corps of Engineers General Permit (GP-58) for this project and would be required to comply with all the terms and conditions set forth in it (see Appendix B).

In addition to co-locating its 115-kV circuit with the existing 48-kV circuit, VELCO proposes to utilize the existing 100-foot transmission corridor right-of-way ("ROW"), even though VELCO's general practice is to maintain a wider 150-foot ROW for 115-kV circuits. Co-locating the transmission circuits on the same pole structures, while maintaining the same 100-foot ROW width, would require the new poles to be approximately 20 feet higher (about 66 feet above ground) than the existing structures in most locations because of the required electrical clearances between the two circuits. (See previous Figure 1-6 for the appearance of the old and new structures.)

There now exist two sections of this line that are under-built with distribution (the distribution line is attached to the poles below the 48-kV transmission line). In the two sections of this line where VEC's existing 12.5-kV distribution line is co-located on the existing 48-kV structures, the poles would need to be approximately 30 feet higher (to about 76 feet). The first section is approximately 1.1 miles long, from the Irasburg Substation to the Linton Parcel, and the other section is approximately 1.3 miles long, along Alderbrook Road in Coventry from the Knight Parcel to the W. & G. Lawson Parcel. The segments are shown in green on Ortho Sheets 1 and 3 in Appendix C. VELCO maintains that, because of the single pole and insulator symmetry, the change to the existing situation would not be significant. The second 1.3-mile segment occurs along Alderbrook Road near Mosher's Tap (Ortho Sheet 3 in Appendix C).

Description of Preferred Alternative Route

The existing transmission-line corridor, which has been in this location since the 1920s for many years, extends approximately 6.47 miles. From south to north, the line departs Irasburg Substation and continues north to Mosher's Tap. As shown on Ortho Sheet 1 of the orthophoto maps included in Appendix C, the existing 48-kV circuit departs Irasburg Substation heading northeast to an angle structure located on the hillside above State Route 14.

From this point, the existing corridor heads north, paralleling Route 14 for a distance of approximately 1000 feet for several spans before it disappears into a thickly wooded area. The line then remains out of sight for approximately one mile before it again reappears at the hillside behind the Djanikian and Bennett residences (mile 1.0 as depicted by a marker shown on Ortho Sheet 1 in Appendix C). The line then crosses Coventry Back Road (mile 1.1; see Ortho Sheet 1 in Appendix C). At mile 1.3, the line then leaves open landscape and enters second-growth vegetation and pasture west and north of Heermanville Road (again, see Ortho Sheet 1 in Appendix C). The line then enters a wooded section at mile 1.7, crossing Linton Road (gravel) at mile 1.8. After the Linton hillside, the line continues northerly on the wooded hillside and crosses the so-called "A & P Marsh Farm" (shown on Ortho Sheet 2 in Appendix C). At approximately mile 3.8, the line crosses Route 14 and stays parallel with Route 14 on the east side at a distance varying from 50 to 100 feet. The line then continues north across Nadeau Park Road (mile 4.1 to mile 4.3) before entering a dense wooded area through Pike Industries land and breaking into the open at mile 4.9 on the Parry Parcel, 400 ft. to the east of Alderbrook Road (Ortho Sheet 3 Appendix C).

The distribution “under-build,” again a segment where the transmission line would have distribution line attached below the transmission conductors on the same poles (see Figure 2-1), begins along Alderbrook Road in Coventry at the Knight Parcel and continues to the W. & G. Lawson Parcel, providing service to both sides of Alderbrook Road for the next 1.2 miles.

Figure 2-1

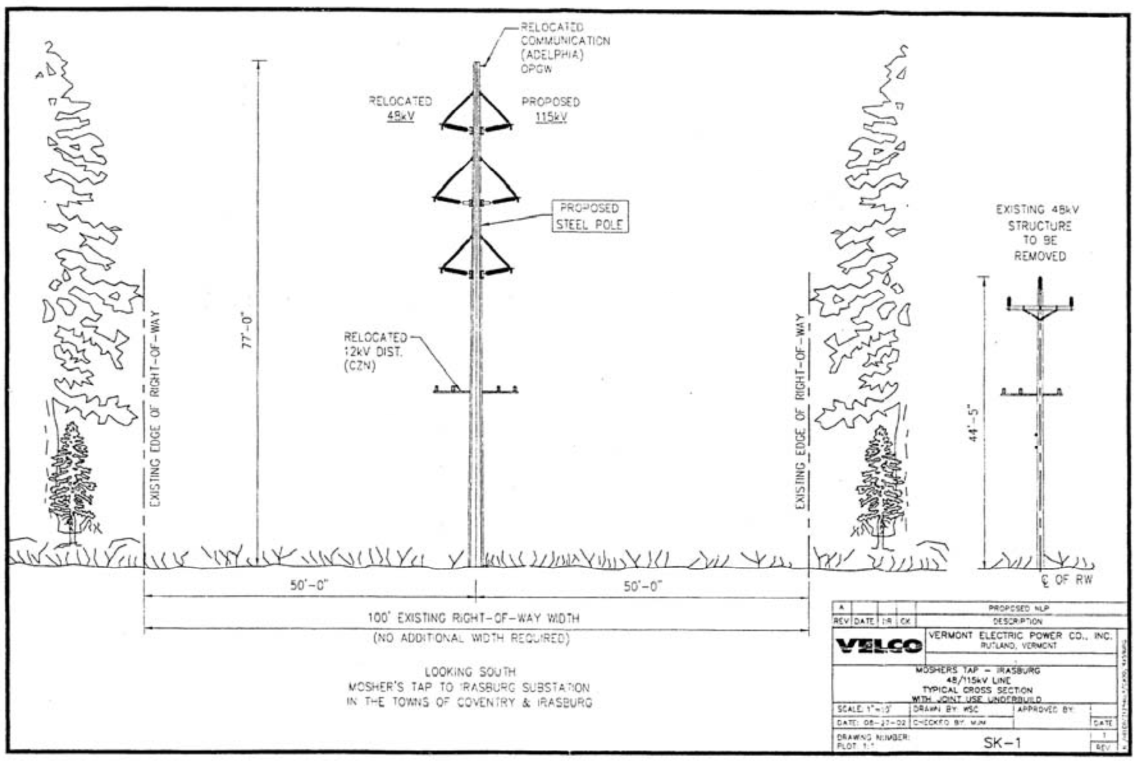


Figure 2-1

At the Mishou rental parcel, the line angles to the west and joins Alderbrook Road (at mile 6.2), where it continues along the Alderbrook Road ROW as a double circuit for 700 ft. or two spans. At this point, the distribution line departs to a pole on the north side of Alderbrook Road, and the 48-kV (and the proposed double) circuit continues the remaining 900 ft. to the Mosher's Tap.

The combined circuits would tie into the 48-kV and 115-kV circuits in an open area north of the Mosher pines.

The existing under-built 12.5-kV distribution line, as mentioned above, starts at the Knight Parcel on Alderbrook Road in Coventry and, along with the 48-kV line, is set back behind the houses (Matheiu, Durocher & Maclure, as shown on Ortho Sheet 3 of Appendix C).

2.1.2 Line Design Specifications and Support Structure

Irasburg to Mosher's Tap

A new 115-kV line would be required to tie Irasburg Substation to Highgate Substation. As part of the Northern Loop Project, VELCO purchased from Citizens its former 120/48-kV, double-circuit, line constructed between Derby Center and Richford substations, labeled as "L3" and "L5," and its former 120-kV line between Richford and Highgate Substations, labeled "L6" on Figure 1–1, shown previously.

VELCO has also purchased its single-circuit Mosher's Tap-Irasburg, 48-kV, transmission line and proposes to rebuild it as a 115/48-kV, double-circuit, line within the existing 100-foot ROW as mentioned earlier. The proposed 115/48-kV, double-circuit, Mosher's Tap-Irasburg line route is labeled as "L4" on Figure 1-1. The new 115-kV line would be tapped into the existing Derby Center-Richford 120-kV line at the same location as the 48-kV tap, near Alder Brook Road and Vermont Route 105 in Newport City, Vermont. ("Mosher's Tap" is labeled "S3" on Figure 1-1. See drawings in Appendix C for the existing and proposed Mosher's Tap configuration.)

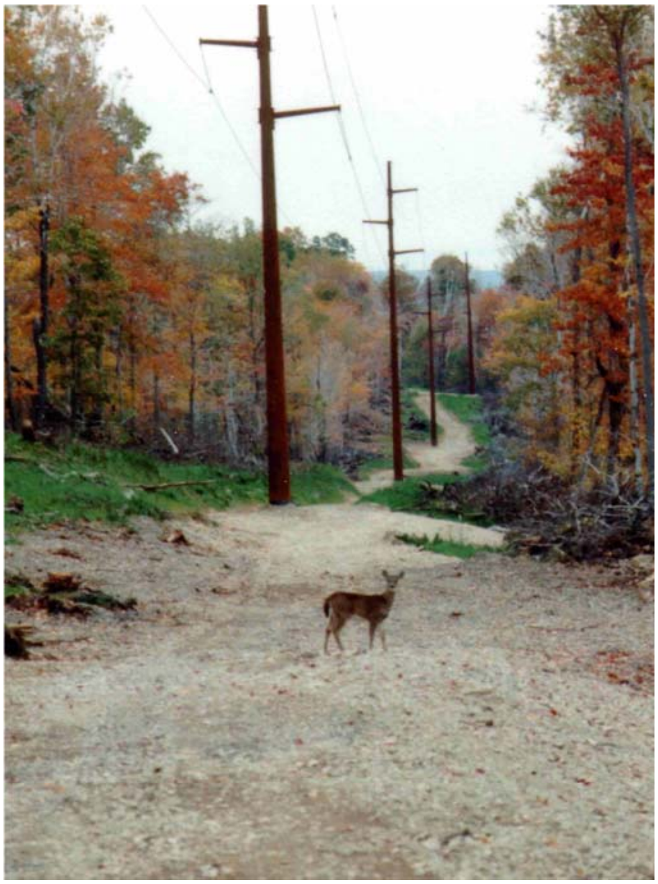
The existing Mosher's Tap-Irasburg 48-kV line utilizes single-bundled, 556-ACSR conductor supported on single wood poles within the 100-foot ROW. The length of the 48-kV line between Mosher's Tap and Irasburg Substation is 5.97 miles. Two short (approximately 1.5-mile) sections of the line carry a 12.5-kV distribution line that is owned and operated by VEC. A fiber-optic cable, owned by Adelphia, runs the entire length of the existing transmission line.

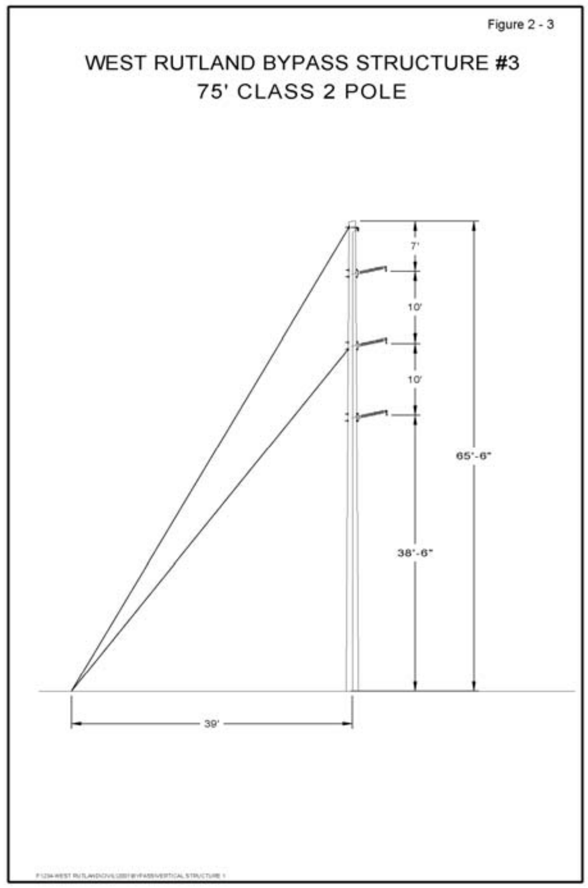
The new line would parallel the existing Mosher's Tap-Irasburg 48-kV line for 5.97 miles to what is now VEC’s Irasburg Substation and then continue another 0.5 miles to VELCO's Irasburg Substation. VELCO would reconstruct the single-circuit, Mosher's Tap-Irasburg 48-kV section of line as a double-circuit 115/48-kV transmission line. The current construction, which uses horizontal phasing on single wood poles, would be replaced with vertically-stacked, double-circuit phasing on single poles (see previous Figure 1-6).

The proposed line would be rebuilt approximately pole-for-pole along the alignment of the existing 48-kV line, with the exception, as previously noted, that VELCO will relocate poles to avoid identified sensitive areas. Both lines would be insulated with 115-kV, braced-post, insulators. Matching the insulation of the two circuits is done for aesthetic purposes and to allow the 48-kV circuit to operate at 115 kV if that should become necessary sometime in the future. This would also make the new line look similar to the existing double-circuit line that is currently at Mosher's Tap.

Because of the aesthetic impacts of creating a new ROW, VELCO determined that the better course of action would be to re-attach the distribution wires on the new poles. Therefore, the new line would utilize a combination of guyed and self-supporting wood, laminated-wood or Corten™ steel poles. (Figure 2-2 provides a photographic example of Corten poles, showing their ability to blend in with the natural environment, and Figure 2-3 provides an illustration of a guyed pole); the appearance of wood poles will be similar.

Figure 2-2 **Figure 2-3**





The new 115/48-kV line would be constructed within the existing 100-foot ROW without the need to acquire an additional ROW. However, where the existing ROW has not been maintained to meet VELCO standards, VELCO proposes to use the full width of the existing ROW by "selective" clearing (i.e., clearing that keeps any vegetation that is slow growing and beneficial to wildlife such as cedars and apple trees) of the ROW's full, 100-foot width. Figures 1-6 and 2-1 above show both existing and proposed configurations.

Even though VELCO purchased the existing ROW easements from Citizens, VELCO is in the process of obtaining all new easements from the land owners along the corridor. The existing easements date back to the 1920s, and VELCO states that it wants easements in place that are in keeping with VELCO's current easement language in order to avoid any claim that the new line would "overburden" the easement (require more property rights than the original easement grants).

Highgate Line

Nearly all of the overhead transmission lines at the two Highgate substations would be rerouted to accommodate the revised termination points that VELCO has proposed. In addition, two new 115-kV sources would be provided; these lines are labeled as "L8" on Figure 1-1. The existing and proposed line work that is associated with the proposed upgrades to Highgate are shown on the Highgate Substation drawings in Appendix C.

A single, 115-kV transmission line presently ties VELCO's Highgate Substation to its 115-kV system from the southwest. This line is tapped off a 115-kV transmission line constructed between the nearby Highgate Converter Station, located approximately 0.4 miles to the southwest, and VELCO's St. Albans Tap, which is located approximately 10 miles to the south.

The existing tap to Highgate is approximately 0.2 miles long and is constructed on wood H-frame structures.

An existing 120-kV line just west of the site would be tapped to provide an additional source for the proposed combined Highgate Substation. This existing line ties TransEnergie's Bedford Substation in Canada to the Highgate Converter Station to the southwest of the site and is referenced as the "North Line"; it is labeled as “L7” on Figure 1-1 above. A new disconnect switch would be cut into the North Line just west of the Highgate Substation. A single-span tap line would be constructed from the Highgate Substation to the North Line. It would tap into the North Line at a location between the new switch and the Highgate Converter Station.

The proposed tap line would be constructed utilizing wood H-frame structures (see Figure 2-4 below) on existing VELCO/VEC Highgate property and the North Line ROW, which is adjacent to it. Again, refer to the Highgate Substation drawings found in Appendix C. Clearing of the isting ROW, as discussed previously, would be required.

A single 120-kV transmission line presently ties VEC’s Highgate Substation to the 120-kV system to the north. This line has been purchased by VELCO and would be converted to the Irasburg-(Richford)-Highgate 115-kV transmission line upon completion of the proposed Mosher's Tap-Irasburg 115/48-kV, double-circuit upgrade. This line is constructed on single-pole, guyed-wood structures as it approaches Highgate Substation. It would be re-routed around the proposed combined Highgate Substation to terminate at the new 115-kV ring bus. Two 48-kV lines would have to be rerouted to new termination points, as well. The re-routes would be

Figure 2-4

constructed utilizing single-pole, guyed-wood structures placed just outside the substation fence on VELCO/VEC property. No additional ROW acquisition is anticipated. However, as discussed above, some tree clearing within the existing ROW would be necessary.

Substation Design

Irasburg and St. Johnsbury

Irasburg.

Irasburg Substation is located on Vermont Route 14 in Irasburg, Vermont. It is labeled as “S2” on Figure 1-1; a photograph of the existing substation and drawings of the existing substation layout are included in the Irasburg Substation drawings found in Appendix C.

The substation contains a single-story control building, one lattice-steel 115-kV box structure, one 115-48 kV transformer, 46-kV bus work installed on a steel-box structure and four 46-kV circuit breakers. One 115-kV line going to the St. Johnsbury Substation currently terminates on the existing 115-kV box structure. The purpose of the substation is to serve Central Vermont Public Service Corporation (“CVPS”)’s 46-kV loads via a line to Lowell plus VEC’s 48-kV loads via lines to Barton and Irasburg and eventually Mosher's Tap. (Note: VEC operates its sub-transmission equipment at 48 kV, while CVPS operates its equipment at 46 kV.)

A drawing showing the proposed Irasburg Substation upgrades are also included in Appendix C. Modifications to the electrical equipment would include the removal of the 115-kV circuit switcher on the St Johnsbury line and the installation of two 115-kV circuit breakers and associated disconnect switches. The new breakers are required to protect the line from St. Johnsbury and the proposed line to Mosher's Tap. Five new, 115-kV potential, transformers would be installed and connected to the 115-kV bus and 115-kV lines for protective relaying and control purposes.

The existing control building would be expanded approximately 10 feet in length (from 30.5 ft. to 40 ft.). The building expansion would be constructed using the same material and color as at present. The control system would be completely upgraded to include redundant control panels and cabling. All new steel structures, including building additions and equipment supports, would be connected to the existing station's ground grid.

St. Johnsbury

St. Johnsbury Substation is located on Higgins Hill Road in St. Johnsbury, Vermont. It is labeled as "S1" on Figure 1-1; a photograph of the existing substation and drawings of the existing substation layout are included in the St. Johnsbury drawings in Appendix C. The substation contains a single-story control building, two tubular-steel, 115-kV-line dead-end structures, one 115-34.5-kV transformer, 34.5-kV bus work and two 34.5-kV circuit breakers. The 115-kV line between Irasburg Substation and Littleton Substation (Public Service of New Hampshire) loops in and out of the substation. The purpose of the substation is to serve CVPS 34.5-kV wholesale and retail loads via lines to Bay Street Substation and Lyndonville Electric Department.

A drawing showing the proposed St. Johnsbury Substation upgrades can be found, again, in Appendix C. Modifications to the electrical equipment would include replacement of the existing 115-kV circuit switchers with 115-kV circuit breakers and two disconnect switches. A third, 115-kV disconnect switch would be installed to isolate one new, 115-kV potential transformer and existing surge arresters connected to the Irasburg line. Three new 115-kV potential transformers would be installed and connected to the 115-kV bus for protective relaying purposes.

Here too, the existing control building would be expanded approximately 10 feet in length (from 30.5 ft. to 40 ft.) to accommodate the new protective equipment. The building expansion would use the same material and color as used at present. The control system would be completely upgraded to include redundant control panels and cabling. All new steel structures, including building additions and equipment supports, would be connected to the existing station's ground grid.

Highgate

The two Highgate substations are located on State Route 78 in Highgate, Vermont. They are labeled "S4" on Figure 1-1; a photograph showing both of the existing substations and drawings of the existing substation layouts are included in the Highgate drawings in Appendix C. As part of the project, VELCO has purchased Citizens' former Highgate Substation and would combine the two yards as one. The South Yard contains a single-story control building, one lattice-steel, 115-kV-line dead-end structure, one 115-48-kV transformer, 48-kV bus work installed on a steel-box structure, four 48-kV circuit breakers and one 48-kV/6.14-MVAR capacitor bank. The South Yard currently ties the VELCO 115-kV and 48-kV systems together with 115-kV connections to the Highgate Converter Station, to St. Albans Tap located to the south, and to 48-kV connections to Village of Swanton Electric Department, the Sheldon Springs hydroelectric station and the former Citizens' Highgate Substation located directly to the north.

The North Yard contains a single-story control building, one A-frame-steel structure, 120-kV-line dead-end structure, one 120-kV circuit breaker, one 120/48-kV transformer, 48-kV bus work installed using low-profile steel structures and five 48-kV circuit breakers. The purpose of the existing North Yard is to serve 48-kV electrical loads with line connections to South Alburg, Richford, and Sheldon Springs and to the South Yard.

As mentioned previously, the North and South Yards would be combined into one yard; drawings showing the proposed upgrades are also found in Appendix C. Modifications to the electrical equipment would include the installation of eight 115-kV circuit breakers, one 115-kV, six-position ring bus, two 115-kV/15-MVAR capacitor banks, one 48-kV/5.4-MVAR capacitor bank, one 115-13.2-kV transformer and two 13.2-kV circuit breakers and may include two 13.2-kV/15-MVAR synchronous condensers.

VELCO, however, is not installing the synchronous condensers at this time. They were needed for voltage support if VELCO were to increase the carrying capacity of the Bedford-to-Highgate line. Because of the cost, VELCO has reevaluated the installation of synchronous condensers and intends to move enough power from contracts over to another interconnection so that it does not have to increase the capacity of the Highgate line.

The existing 48-kV bus and circuit breakers currently located in the South Yard would be removed from the site. The existing 48-KV/6.14-MVAR capacitor bank currently located in the south yard would be moved to the northeast corner of the newly-combined yard. The 115-kV ring bus would be installed initially as a five-breaker, six-position, ring bus with future expansion possible to a six-breaker, six-position, ring bus. The ring bus would be constructed using four bays of lattice-steel structure with strain bus and two sections of tubular aluminum bus to complete the ring.

Three 115-kV transmission lines would terminate on the ring bus, and one 115/48-kV transformer would connect to the fourth position. The fifth position would feed 115-kV station service and also eliminate the crossing of two 115-kV lines which would increase reliability. Transmission lines connecting to the 115-kV ring bus would include a line to VELCO's Georgia Substation via St. Albans Tap, and may include a line to the synchronous condenser, and would include a 120-kV feed from TransEnergie (operated normally open) and a line to Newport Substation. The two 115-kV capacitor banks and synchronous-condenser-related equipment, if installed, would be located in the northwest corner of the substation. The new 48-kV capacitor bank would tap off the existing Alburg 48-kV line position and would be located centrally in the yard.

The existing control building located in the North Yard would be expanded approximately 19 feet in length (from 25 ft. x 35 ft. to 25 ft. x 54 ft). The building expansion would be constructed using the same material and color as used at present. The building expansion is necessary to house DC–station power batteries, AC-station auxiliary-power equipment and system-protection and control systems. The existing control building located in the South Yard would be removed from the site. The control system would be completely upgraded to include redundant control panels and cabling. The ground grid would be expanded to encompass the entire combined station. All steel structures, including buildings and steel-equipment supports, would be connected to the ground grid. The perimeter fence would also be connected to the station's ground grid.

St. Albans

St. Albans Substation is located on Nason Street in St. Albans, Vermont; it is labeled as "S5" on Figure 1-1. The substation is presently tied to VELCO's 115-kV system by a single line, which is tapped off the Highgate-St. Albans-Georgia line mentioned previously.

The line tap is located approximately 5,560 ft west of the substation at a location referred to as "St. Albans Tap"; a photograph of the existing tap site and drawings of the existing tap-structure layout are included in the St. Albans Tap drawings in Appendix C. The St. Albans Tap site currently consists of a 115 kV steel-transmission-line tap structure but is otherwise undeveloped.

Modifications to the St. Albans' Tap site include removing the existing steel-transmission tap structure and installing a small switching station; drawings showing the proposed upgrades are also included in Appendix C. Electrical equipment installed in the station would include two 115-kV load-break disconnect switches, surge arresters, grounding switches and a 115-kV station-power transformer. A small control hut, approximately 10 feet wide by 10 feet long, would be installed at the base of the tap point to house control devices and auxiliary AC and DC power equipment for the new equipment. The control hut would be a pre-engineered building of pre-fabricated steel and would be similar in appearance and color to the existing St. Johnsbury Substation and Irasburg Substation control buildings. A ground grid would be installed below grade over the developed site. All new steel structures, including the control hut and steel equipment supports, would be connected to the station's ground grid. A chain-link fence would enclose the station, and the surface of the yard would be crushed stone. Access to the new switching equipment would utilize the existing transmission-line maintenance road, which may require a minimal amount of grading and the addition of crushed rock surfacing material.

2.2 Alternate Routes for the Double-Circuit Line from Mosher’s Tap to Irasburg

2.2.1 Alternative Route Options

VELCO determined that the most feasible possible corridor for this project is the proposed route, which benefits from the use of an existing right-of-way. However, other corridors were considered, of which one was immediately eliminated due to environmental impacts. The other two alternative corridors, referenced in this EA as the “New Corridor Alternative” and the “Partially New Corridor Alternative” (being a combination of the proposed corridor and a part of an alternative corridor), would have required acquiring all new easements and clearing of at least 100 feet of ROW for the 6.47-mile distance.

With either of the alternatives, the existing 48-kV ROW would remain where it is today; that is to say that both alternatives would result in two power line corridors: a new, single-circuit, 115-kV line and the existing 48-kV line. As the existing line must still serve VEC’s Irasburg Substation and residential customers who live along one mile of the existing line, and as the cost of the 48-kV line would not be supported by the New England Power Pool as “Pool Transmission Facilities,” VELCO determined that it could not relocate the existing 48-kV line if either alternative were chosen.

The two alternative corridors are described below. Deciding to stay within the existing corridor, however, is consistent with the State of Vermont's policies and the planning guidelines of the towns and regional planning commissions through which the line passes and in which the substations are located.[11]

---

11 In 1988, the Vermont General Assembly passed Act 200, entitled "An Act Relating to Encourage Consistent Local, Regional and State Agency Planning." Act 200 provided, among other things, that "development and expansion of governmental and public utility facilities and services should occur, where appropriate, within highway or public utility right-of-way corridors in order to reduce adverse physical and visual impact on the landscape and achieve greater efficiency in the expenditure of public funds." In an effort to simplify and streamline the purposes and goals relating to municipal and regional planning and development, this provision was replaced by the legislature in 1990 with more general language. However, the underlying objective of using existing ROWs remains a goal of the legislation, as reflected in the regional plans prepared by the Northeastern Vermont Development Association (NVDA) and the Northwest Regional Planning Commission (NRPC).

NVDA's regional plan (Appendix D) for the Northeast Kingdom (the area within which that the Irasburg-to-Mosher's Tap line resides) states in Section IX, Land Use Plan Paragraph B, that future land use should be concentrated in areas where similar activities already occur. The Northern Loop Project, using the existing corridor as proposed, is consistent with NVDA's plan because the transmission improvements planned for the NVDA region would be constructed within existing utility ROWs and at existing substations.

The plan of the NRPC (Section 2.2.1 -2 in Appendix D), which serves the region in which the Highgate Substation and line improvements and the St. Albans improvements are located, states in Chapter 7, Energy:

> In the evaluation of all energy projects, those with the least adverse environmental, aesthetic, economic and social impacts are preferred.
>
> Generation, transmission and distribution lines or corridors should avoid adverse impacts on significant wetlands, plant and animal habitat, and recognized historic, natural, or cultural resources.
>
> Plans for generation, transmission and distribution lines should incorporate the following design principles: a) rights of ways shall not divide land uses, particularly agricultural lands and large contiguous forest parcels, b) topographical features should be used to minimize the visual impacts of corridors. Corridors, lines and towers should not be placed on prominent geographical features such as ridge lines and hilltops, and c) placement and maintenance of utility lines should minimize the removal of vegetation and disruption of views from public highways, trails, and waters.

Also, in Chapter 8, Land Use, one of the general policies listed is:

> Construct corridors for new energy transmission facilities only when there is a demonstrated need, and then these should be built adjacent to and parallel to existing operational energy transmission corridors. Visual impact of these facilities should be minimized and should avoid sensitive natural features and historic resources.

The Northern Loop Project is consistent with the NRPC Plan because, as stated above, all of the transmission improvements would be constructed within existing utility ROW and at existing substations.

The towns affected by the project, St. Johnsbury, Irasburg, Coventry, Newport, Highgate, and St. Albans, do not provide town plans with specific guidance regarding the siting of transmission facilities.

The two alternatives considered by VELCO are described below:

New Corridor Alternative:

This alternative (Ortho Photos in Appendix E, Sheets 1-10) departs westerly from Irasburg Substation through a mixed woods for 0.1 miles, crosses an open agricultural field for 0.3 miles and then angles northerly on the west edge of a drainage way at 0.5 miles. This angle point is in agricultural land (corn) and is visible from the adjacent farmhouse on Back Coventry Road.

Heading north on the back edge of the field, this alternative corridor crosses Back Coventry Road on a wooded curve at 0.7 miles (Appendix E, Photo 1). The corridor continues north in woods skirting the west side of the above-mentioned drainage way, angling (at 0.9 miles) through regenerating fields ascending the western slopes of the Back Coventry Road valley in a northwesterly direction (Appendix E, Photo 2). It again angles northerly, avoiding, by about $^1/_5$ of a mile, four or five houses clustered at the end of Chilafoux Road. Through this diversion on

---

Use of an existing ROW is also consistent with the Vermont Twenty Year Electric Plan adopted by the Vermont Department of Public Service (pages 5-19):

> Upgrading existing transmission facilities to accommodate higher power transfer levels within existing corridors is clearly the preferred method of increasing the capacity of Vermont's bulk transmission capacity of environmental grounds … Vermont's existing corridors should be upgraded prior to considering new corridors unless it can be demonstrated that the use of such a measure would have a substantial adverse impact on the electric system or societal costs, or the use of such a preferred measure would prevent desirable economic energy transactions with other utilities from occurring.

In the findings issued by the Public Service Board in Docket No. 3481 (See Section 2.2.1–11 in Appendix D) for constructing a 115-kV transmission line from Bennington to East Arlington, the Board complimented VELCO for "planning to meet growth without an appreciable impact on land use. Although this is the first case where VELCO is substituting [a proposed new line] for an existing line, we hope that circumstances would permit more applications of this type."

the hillside above the houses, it travels at the woods' edge (Appendix E, Photo 3), descending the hill and angles to cross over a wooded draw and then Linton Hill Road just south of the fork at Reservoir Road (mile 2.1) (Appendix E, Photo 4). The Linton Residence is $^{1}/_{10}$ of a mile up hill to the west separated by coniferous woods.

The corridor continues northerly on the edge of an open field and enters deciduous woods at 2.7 miles, descending into the Route 14 valley and paralleling the existing 48-kV corridor, offset by $^{1}/_{10}$ of a mile, for a distance of 0.4 miles. Angling (at mile 3.5), it ascends the hillside at the interface of deciduous and coniferous woods before entering a mixed open and wooded landscape (at mile 4.0) crossing Petit Road (at mile 4.1) (Appendix E, Photo 5). This crossing is open, and the structure would be exposed to view on this gravel road serving several farms.

At mile 4.2, the corridor enters deciduous woods (Appendix E, Photo 6), angles and proceeds northeast passing through or on the edge of predominantly coniferous vegetation. It then crosses Route 14 (at mile 5.2) in a valley constriction, skirting the east side of extensive gravel pits. This location is $^{1}/_{5}$ of a mile northeast of Alderbrook Road (Appendix E, Photo 7 and 8).

From Route 14, the line traverses the high ground above and paralleling Alderbrook Road at a distance of $^{1}/_{3}$ of a mile. The line ascends the hillside (to mile 6.0) at the edge of open agricultural land and then descends diagonally through mostly coniferous woods to the Alderbrook valley floor (at mile 6.3). From here north (for 0.8 miles), it travels at the interface of the western slope and valley floor at the edge of patchy woods.

The residences on Lane Road at greater than $^{1}/_{10}$ of a mile's distance may have limited views of the corridor. Suburban houses on the east side of the Alderbrook valley would have views to the corridor for about $^{3}/_{5}$ of a mile, from mile 6.3 to mile 6.9. The views of the line would, however, include the hills on the west side of the valley and the intermittent vegetation in the background and would be at a distance of $^{2}/_{5}$ of a mile from the homes. The corridor traverses a wooded ravine and taps the former Citizens (now VEC) 115-kV corridor at mile 7.0.

The existing corridor for the 48-kV line would remain where it is today.

Partially New Corridor:

This alternative is a sub-corridor of the existing (applicant's preferred) corridor and the New Corridor Alternative. This alternative corridor (see Partially New Corridor Alternative orthophotos in Appendix E) would follow the existing right-of-way from Irasburg Substation, continuing north across Nadeau Park Road (miles 4.1 - 4.3), entering a dense wooded area through Pike Industries' land before breaking into the open at mile 4.9 on the Parry Parcel 400 ft. to the east of Alderbrook Road. At this point, the Partially New Corridor departs from the proposed corridor, moving to the other side of the valley as described next.

From Route 14, the line traverses the high ground above and paralleling Alderbrook Road for a distance of ⅓ of a mile. The line ascends the hillside to mile 6.0 at the edge of open agricultural land and then descends diagonally through mostly coniferous woods to the Alderbrook valley floor at mile 6.3. From here north (for 4/5 of a mile), it travels at the interface of the western slope and the valley floor at the edge of patchy woods.

The residences on Lane Road (at greater than $^{1}/_{10}$ of a mile from the Partially New Corridor Alternative) may have limited views of the corridor. Suburban houses on the east side of Alderbrook Valley would have views to the corridor for about $^{3}/_{5}$ of a mile, from mile 6.3 to mile 6.9. However, the corridor would have the hills on the west side of the valley and the intermittent vegetation in the background and would be at a distance of $^{2}/_{5}$ of a mile from the homes. The corridor traverses a wooded ravine and taps the former Citizens 115-kV corridor at mile 7.0.

2.3 Comparison of the Proposed Route (Preferred Alternative) and Alternative Routes

The New Corridor Alternative would require all-new clearing of vegetation, for a ROW 100 feet wide, in areas where the existing corridor is now not very visible. Both alternatives would affect residents living on Lane Road and still be very visible from Alderbrook Road and the residents who today have an open agricultural view. Additionally, the 48-kV line and the distribution line would remain as it exists today.

As stated at the previous section's outset, VELCO's view is that staying in an existing ROW would minimize the proposed project's impact and is consistent with the policies of the State of Vermont and the regional planning commissions (see previous footnote 11). VELCO stated that it investigated the Partially New Corridor Alternative to the point of contacting affected landowners, several of whom were strongly opposed to this new route. Because of the relocation, VELCO believes, either alternative would result in a second, highly-visible corridor (additional to the existing corridor for the 48-kV that would remain where it is today), so VELCO decided not to pursue either alternative route any further. See table 2.3 in Section 4.22, which provides a comparative analysis of the two corridors.

2.4 Alternative Line and Substation Designs

2.4.1 Alternative Conductor and Pole Size

As described in section 2.1.2, VELCO designed the Mosher's Tap-Irasburg line using 1272 ACSR conductor for the 115-kV circuit and 556 ACSR for the 48-kV circuit. Spans were to be kept as close to the existing line as possible except where it would be environmentally beneficial to change them.

VELCO originally considered using wood poles, then switched to all steel poles and ultimately decided to use a combination of wood and laminated-wood poles except when steel poles are necessary. To prepare a cost estimate for wood-pole-line construction, VELCO originally thought one or more of three previously-identified basic design criteria for this project would have to be changed to reduce the load on the structures; that is, the wire size, pole spacing or framing configuration. Wood poles have lower load-carrying capacity; hence the need for either very large wood poles or shorter spans with more poles. To develop comparable cost estimates, VELCO developed a wood-pole-construction estimate based on reducing the pole spacing while utilizing the same double-circuit framing and wire sizes used to prepare the steel-pole estimate.

To accomplish this, the maximum span for the sections of line supporting 12.5-kV distribution line was reduced to 410 ft. utilizing 74.5 ft.-tall wood poles. Similarly, the maximum spans for sections of line without 12.5-kV under-build was reduced to 485 ft. utilizing 70 ft.-tall wood poles. For comparison, the original pole-for-pole replacement design was based on average spans of 362 ft. with maximum single-pole spans of as much as 525 ft.

One or more of the three basic design criteria could be modified to allow the use of wood-pole construction along the entire route. These include: reducing wire size; reducing the pole spacing; or re-configuring the structure framing, as follows:

Reduced Wire Size

One of the double-circuit wires that the steel pole was originally designed to support is 1272 ACSR, and the other circuit is 556 ACSR. Assuming that the 48-kV-circuit, 556-ACSR wire would not change, VELCO originally analyzed the effect of reducing the size of the 115-kV circuit wire on a tangent structure with 12.5-kV under-build and a maximum span of 475 ft. Reducing the 1272 ACSR to a 556 ACSR reduces the load on the structure to just below 100% of the allowable capacity of an H-6 wood pole at all locations.

Reduced Pole Spacing

VELCO also concluded, originally, that the maximum pole spans would have to be reduced from the desired 475 ft. spacing to 410 ft. for the two-mile sections of line supporting 12.5-kV distribution under-build, and from 525 ft. to 485 ft. for the remaining 4.5 miles.

Re-configured Structure Framing

The double-circuit framing can be modified in a wide variety of ways, which might require using two or more poles at each of the ten tangent-structure locations that require a steel pole. As an example, the new 115-kV line could be built along the existing 48-kV line on a separate, single-circuit, single-pole structure. Two-pole, crossed-braced construction methods could also be used to support the two circuits, either by vertically stacking the circuits side by side on separate poles that are crossed-braced together or by using double-tier H-frame structures by horizontally positioning the 115-kV circuit over the 48-kV circuit.

VELCO Standard Construction

VELCO determined that any new 115-kV construction, including the project's 115-kV line, should utilize 1272 ACRS conductor, for the following reasons:

1. Future electric power-flow requirements are unknown at this time. Typical power flows are on the order of a few MW to over 60 MW, with higher flows common when the Highgate Interconnection Facilities operate. These flows can be changed by numerous factors, including Highgate imports from TransEnergie, load level, PV20 imports from New York, operation of the Comerford and Moore stations at the Connecticut River, internal-to-Vermont hydroelectric-station output, dispatch of the McNeil Station in Burlington (and other Vermont-located thermal station(s)); power transfers within and through New England and VEC's load swaps to the VELCO network at Irasburg and Highgate during daily operations.

Potential changes in the local network affect this flow too. Connecting the Lyndonville load or Barton load to the Irasburg–St. Johnsbury line would change the flow on the Irasburg–Highgate line (and typically increase it when the Highgate Interconnection Facilities are operating). Any generation that comes on-line in the area would change flow patterns also. For all of these reasons, the flow on this newly-built line cannot be predicted with any accuracy.

If, for the sake of argument, a 50-MW flow were assumed on the new line during operation of the Highgate Interconnection Facilities, then the reduction in line losses due to a switch from the lighter 795 to the heavier 1272 ACSR conductor would be about 0.06 MW. Assuming 6000 hours/year of Highgate operation, and a $50/MW-hr energy cost in the Vermont load zone, over the course of a single year the reduction in losses would yield about $18,000. An incremental cost estimate for the cable of utilizing 1272 ACSR instead of 795 ACSR, based on the conductor alone, is about $0.65 per foot or $3432 per mile plus $4000 per mile for installation-hardware changes. Given a new line length of 6.47 miles, the added cost would be about $48,100 to use the heaver 1272 ACSR. Accordingly, the reduction in losses alone on the line would account for the total incremental cost borne by NEPOOL of the 1272 ACSR conductor in less than three years. (About $18,000/year energy cost savings *vs.* a one-time extra cost of $48,100 for installation of the heavier cable.)

2. Since VELCO does not know if, and when, future system changes – e.g., load growth, new local generation, a loss of the Highgate or PV20 ties or the McNeil Power Station for a period of time – would occur, the best choice is deemed by VELCO to be to install a

conductor having sufficient rating to provide flexibility to accommodate uncertainty. Currently, 1272 ACSR conductor is the conductor of choice for potentially thermally-constrained, 115-kV transmission paths in the VELCO network. This conductor, if built to operate at a temperature of 100^{o}C (212^{o}F), should allow roughly a 300-MW flow during summer peak-load conditions.

3. If a smaller conductor were used now and later circumstances were to require installing a larger conductor, the incremental time and cost to reconductor the 6.47 miles of line would be of concern. VELCO estimates five weeks for construction and $88,000 for manpower costs if VELCO line crews were used; the use of non-VELCO line crews would likely be a more expensive option. In addition, re-conductoring this length of line separately at a later date would also unavoidably involve at least some second occurrences of service disruptions or system reconfigurations when compared to simply installing the 1272 ACSR conductor at the time the initial Northern Loop Project construction occurs.

4. VELCO has used essentially the same standard 115-kV line design since its inception. The standard conductor size in the VELCO 115-kV network is 795 ACSR. This conductor is capable of carrying roughly 200 MW of flow during summer peak-load conditions. VELCO's 115-kV network has shown few thermal limitations since its creation in 1956 and construction of the bulk of the 115-kV network in the late 1950s, the 1960s and early 1970s. This means that VELCO's 795 ACSR choice was frequently larger than needed at the time of installation, based on thermal needs, but has resulted in loss benefits over the decades and precluded the need to reconductor or rebuild the bulk of the company’s system for the better

part of a half century. VELCO today views this 795 ACSR conductor choice as thermally limiting on key 115-kV-line sections. Given this fact and the high demands placed on the VELCO system today in terms of loads served and the unpredictable uses of the network in today's utility "landscape," increasing the size of VELCO's standard conductor for newly-built, 115-kV lines to 1272 ACSR is both logical and practical.

2.4.2 Undergrounding the Transmission Line

VELCO also estimated the cost of the alternative of underground-transmission-line construction. The estimated cost per mile for a 115-kV underground construction alternative is about $2.7 million/mile. This cost includes overhead-to-underground transition structures and additional equipment required at each end of the line.

While eliminating visual impacts, underground construction has adverse impacts on the environment in addition to significantly higher costs. Although underground-transmission cables require a narrower ROW when compared to overhead transmission lines, they also involve the excavation of a continuous trench and the installation of underground splice vaults, which must be accessible for maintenance purposes.

Whereas an overhead-transmission line can span steep slopes, rock outcroppings, vegetation, wetlands and watercourses, and agricultural land, underground cable routes typically require excavating through or beneath such resources. Underground construction also requires access along the entire route for trenching equipment and for trucks delivering ductwork, splice vaults, backfill, concrete, cable and other heavy construction materials and equipment.

2.4.3 Alternative Substation Designs

No alternate substation designs were studied with the exception of changes made to the Highgate Substation and the St. Johnsbury Substation as outlined in the Stipulation between VELCO and the Vermont Department of Public Service and the Vermont Agency of Natural Resources (see Appendix B).

The final design for the Highgate Substation included the following alternative features:

1. Install switching equipment that allows for the proposed synchronous condensers to be operated on either the north or the south side of the substation;

2. Remove the proposed transmission line from the existing Highgate Converter Station to the Highgate Substation; and

3. Add a switch at the point where the existing transmission line from the Highgate Converter Station taps into the existing transmission line running south from the Highgate Substation.

The alternative design for St. Johnsbury Substation includes installing two circuit breakers (the original plan had one circuit breaker and a position for a future breaker).

As an alternative to the St. Albans Tap, VELCO briefly considered constructing a parallel, 115-kV, line approximately one mile from the existing tap location to St. Albans Substation. VELCO rejected this proposal without further investigation as the alternative would require VELCO to widen the ROW, create new, visible structures, potentially have other incremental impacts to the environment, and increase the project's cost, which would be compared to the reliability benefit of eliminating one mile of radial feed.

2.4.4 Comparison of the Proposed Design and Alternative Designs

Modifying the line-design criteria in the manners outlined above would entail various undesirable or unacceptable impacts on the project. Steel poles would still be required for ten of the larger tangent spans given the pole-for-pole replacement criteria and possibly for additional spans where self-support angle and dead-end poles are required within wetlands. Reducing the 115-kV-circuit conductor size from 1272 ACSR to 556 ACSR would reduce the current-carrying capacity of the line by over 25%, thereby resulting in a reduction of load-carrying capability of more than 100 MW.

Reducing the pole spacing would, further, require VELCO to place more structures closer together along the corridor, which was not acceptable to adjacent property owners based on conversations between VELCO consultants and ROW agents and the landowners. Furthermore, reduced spans across wetlands and watercourses might not be acceptable or possible. Finally, the increased number of structures would also increase the overall cost of the line as compared to the steel-pole line originally proposed.

Reconfiguring the double-circuit framing by any of the methods considered previously would have negative impacts on the project. Each of the options would increase the visual presence of the line by doubling the number of poles at each tangent location and also require additional ROW and vegetation clearing if used in succession. Additionally, guyed, wood-pole structures within any wetlands would increase the disturbance to these protected areas. Finally, the "over/under" circuit configuration would impose undesirable maintenance restrictions and reduce the lines' reliability.

2.5 Alternatives to the Proposed Project

Section 1508.9(b) of The Council of Environmental Quality regulations for implementing NEPA (40 CFR Parts 1500 – 1508) requires that an EA "Shall include brief discussions…of alternatives as required by §102(2)(E) [of NEPA], of the environmental impacts of the proposed action and alternatives …" The above-cited §102(2)(E) of NEPA requires that the agency "study, develop, and describe appropriate alternatives to recommend courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources."

2.5.1 The No Action Alternatives

Under the No Action Alternative, no upgrades or rebuilds to the existing transmission-line system would be constructed in the project area, and only essential maintenance activities would continue to be performed as they have been up until now. Existing structures and hardware would be maintained, repaired or replaced as required during routine maintenance activities or in the event of emergency outages of the transmission lines. However, it is reasonable to anticipate that repairs would be required with increasing frequency in the future as the transmission lines increase in age.

Implementation of the No Action Alternative would preclude the anticipated effects to the environment that would be associated with the Proposed Action. Minor adverse effects, however, would result from the increasingly frequent repairs and maintenance activities.

However, VELCO advises that “No Action” could prevent VELCO from proceeding with certain parts of the project by which electricity flows from the Hydro-Québec to the VELCO system (over the facilities authorized by the two Presidential Permits previously issued by DOE). If VELCO were unable to proceed with the project otherwise, significant electrical loads in northern Vermont would continue to be served by the existing radial transmission lines such that the lines’ loss would, in many intermediate-to-peak conditions on the VELCO system, likely result in the electrical utilities in northern Vermont supplied by VELCO being unable to serve all customer load. Such inadequate capacity situations could result in “brownout” or “blackout” conditions which, in turn, could result in indirect environmental impacts.

For example, non-functioning traffic signals could cause traffic delays, and hence small amounts of increased atmospheric emissions, from vehicle engines in towns and cities such as St. Johnsbury or Newport. Public institutions, such as hospitals, might have to use back-up generators causing increased emissions.

2.5.2 The Generation Alternative

Generation was considered as an alternative to the Northern Loop Project. For a generation option to be a true alternative, it must be in the correct location, sized appropriately and available when needed. Given the size of the load pockets around St. Albans to Fairfax (55 to 60 MW) and St. Johnsbury (30 MW), the minimum size of generation needed to provide a comparable level of reliability to that of the Northern Loop Project would be about 15 to 20 MW in each load pocket.

Prices for used generators of this size were obtained on-line: One power-equipment manufacturer indicated purchase prices in excess of $5,000,000 for each unit. The price typically did not include transport or set-up of the unit, incidental equipment (such as a fuel tank) for the unit and necessary installation costs, like site acquisition, permitting, set-up, and fuel delivery. If the set-up costs were assumed to be double the unit costs, then the generation option would cost on the order of $20,000,000 without accounting for operating costs.

For the generation option to yield the loss savings, maintenance flexibility and reliability improvements, the units would need to run thousands of hours a year. If the running costs for the units were, for example, $60/MW-hr, and the units had to run for 4000 hours a year to begin to achieve an equivalent level of performance, the added cost would be 40 MW x $60/MW-hr x 4000 hours = $9,600,000/year.

This compares to VELCO's total project cost of an estimated $22.65 million and estimated low annual operating costs. VELCO states, however, that the annual operating costs of the generation alternative would still be in the millions of dollars per year.

The generation would have significant environmental impacts. The impacts would include additional site impacts from generation siting that would require either an entirely new substation or a major addition to an existing substation; additional space for fuel storage; and a related, significant, increase in truck or rail traffic to supply the fuel. For reliability purposes VELCO believes that dispatchable[12] fossil-fuel generation would be necessary (an alternative in northwestern Vermont would be to have the existing, natural-gas pipeline enlarged and extended, since at present it does not have the extra capacity to supply a major generator) thus resulting in an increase of air pollutants and other environmental emissions. In addition to these impacts from power generation, some of the proposed transmission upgrades would still be required to provide access to the transmission grid for any generation installed as an alternative means of maintaining reliability (the new power sources would have to be connected to the grid).

Accordingly, due to the high cost to achieve similar performance, and the significant environmental impacts that likely would occur, VELCO determined that this alternative would not satisfy the utility's purpose and need and decided not to consider this option further.

---

[12] The meaning of this term depends on the context in which it is used. To dispatch is to control flow and direction. Just as taxi dispatch controls how many cabs are assigned to specific areas of a city, energy dispatch controls how much energy travels through specific transmission stations to end-use service areas. Just as a taxi company requires a dispatcher to communicate with individual cabs, energy dispatch requires a human operator to schedule, monitor and control distribution of energy. Dispatch also denotes the process of coordinating the distribution of energy on a moment-to-moment basis to meet changing load requirements (Ref.: EnergyVortex.com).

2.5.3 The Conservation, Fuel Conversion, Demand-Side Management Alternative

VELCO's analysis of alternative, demand-side-management or "DSM" measures, which would have low impact on the environment as customers would install or use measures typically at their premises potentially reducing the need to construct transmission reinforcements, started with the State of Vermont's load forecast, prepared by the Vermont Department of Public Service in August 2002. Then, utilizing all the research that went into the report, titled "Electric and Economic Impact of Maximum Achievable Statewide Efficiency Savings" published by Optimal Energy (May 29, 2002) and provided in Appendix B, the summer MW deductions from peak demand resulting from DSM measures were used to come up with a dollars-per-kW of reduction for peak demand in summer. Those calculations were then applied to the project. Please refer below to Figure 2-5 for details.

Summary of Results from the DPS May 29, 2002 Study of "ELECTRIC AND ECONOMIC IMPACTS OFMAXIMUM ACHIEVABLE STATEWIDE EFFICIENCY SAVINGS"

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Summer Peak forecast (MW) from DPS August '02 Forecast (1)	1012.0	1039.0	1057.0	1098.0	1124.0	1144.0	1168.0	1191.0	1216.0	1244.0
% growth from previous year		2.7%	1.7%	3.9%	2.4%	1.8%	2.1%	2.0%	2.1%	2.3%
Annual Summer Peak MW Reduction From Energy Efficiency	25.1	33.2	42.6	53.1	59.2	60.9	60.7	57.6	50.6	47.9
Summer Cummulative Peak Reduction	25.1	58.0	99.9	151.9	209.2	266.9	323.4	373.8	414.1	449.3
Annual Peak Reduction as % of Peak	2.5%	3.2%	4.0%	4.8%	5.3%	5.3%	5.2%	4.8%	4.2%	3.9%
Cummulative Reduction as % of Peak (2)	2.5%	5.6%	9.5%	13.8%	18.6%	23.3%	27.7%	31.4%	34.1%	36.1%
Annual Cost ($1,000)	$ 71,026	$ 92,509	$ 120,381	$ 154,077	$ 199,078	$ 234,567	$ 234,187	$ 223,045	$ 200,150	$ 184,454
$/Summer kW Reduction	$ 2,827	$ 2,786	$ 2,826	$ 2,902	$ 3,361	$ 3,854	$ 3,860	$ 3,873	$ 3,952	$ 3,849

Notes:

1) This forecast was not included in the DPS Study. It is from the forecast the DPS provided VELCO in August 2002 and excludes load served in Conn Valley.

2) This percentage is calculated from the summer MW reductions in the DPS Study divided by the summer peak forecast

Apply Same Assumption of the DPS Study to VELCO Northern Loop

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Peak Load Forecast for Northern Loop (1)	150	154	157	163	167	170	173	177	180	184
Cummulative Reduction as % of Peak from Energy Efficiency (2)	2.5%	5.6%	9.5%	13.8%	18.6%	23.3%	27.7%	31.4%	34.1%	36.1%
Cummulative Summer Peak Reduction Achieveable from Energy Efficiency	4	9	15	23	31	40	48	55	61	67
Peak Reduction Required to Maintain Northern Loop Load at a 95 MW Peak (3)	55	59	62	68	72	75	78	82	85	89
$/Summer kW Reduction (2)	$ 2,827	$ 2,786	$ 2,826	$ 2,902	$ 3,361	$ 3,854	$ 3,860	$ 3,873	$ 3,952	$ 3,849
Cummulative Cost ($1,000)	$ 10,528	$ 24,118	$ 41,673	$ 63,998	$ 92,578	$ 125,537	$ 157,869	$ 186,769	$ 210,378	$ 230,494

Notes:

1) Assume Northern Loop Load (St. Johhsbury, St Albans/Fairfax and CZN Block Load) grows in proportion to state wide load

2) Apply results from DPS Statewide Study to Northern Loop Load

3) Combined St. Johnsbury, St Albans/Fairfax and CZN Block Load can not exceed 95 MW to maintain first contingency capability

Figure 2-5

The Northern Loop Project load was then increased by the State's load-growth percentage for Vermont. Then, the percentage of peak that was forecasted to be maximally achievable by DSM was applied to this forecasted peak. By 2012, seven years after the project is to be completed, VELCO concluded that DSM would have to eliminate almost 90 MW of load in northern Vermont to meet the same level of reliability that would be achieved by the Northern Loop Project. Using the above calculations, DSM measures, including increased fuel conversion, would achieve a reduction of only 67 MW at a cost of $230,000,000.

VELCO accordingly concluded that DSM would not provide an adequate or cost-effective alternative to the Northern Loop Project and hence would not meet VELCO's purpose and need.

2.6 Construction Activities

Whether located in an existing or new corridor or location, the construction of a power line or substation has the potential to cause certain impacts, which are analyzed in this section.

2.6.1 Transmission Lines

The construction of a transmission line requires surveying, clearing, access-road construction, pole placements and framing and stringing of line. These activities would occur whether the line is built in a new or existing corridor although the intensity of possible environmental impacts may vary (*e.g.*, construction of a new access road would likely have a greater impact than the repair of an existing access road).

2.6.1(a) Surveying Activities

Preliminary design surveys require access to the lands to be crossed by the line. The surveys show route location, physical features and property data as well as wetlands and sensitive archaeological areas. Final pole placement is determined prior to construction.

2.6.1(b) Right-of-way Clearing and Maintenance Practices

VELCO proposes to clear the full 100-foot existing ROW utilizing a selective-clearing and ROW-management approach to limit the impacts of tree clearing where possible. VELCO determines whether to eliminate, control by trimming or topping, or save a tree by such criteria as location, age, health, and present line clearance. Other factors include ownership, aesthetic and environmental values such as wildlife habitat, water-resource areas, etc.

On a typical stretch of ROW, all fast-growing tree species are cleared. These include softwoods such as white pine, spruce, balsam fir and larch and hardwoods like aspen, maples, birches, cherry, locust, elm, ash, and oak. At road crossings or at special scenic locations, the trees may be topped, thinned out (removal of older, taller trees), or removed and replaced by another low-growing species. Trees and shrub species that may be saved where possible are cedar, apple, pear, hazelnut, dogwood, sumac and shadbush. Some softwoods, such as white pine, balsam, and spruce, may be left on the ROW for more than one clearing cycle for visually aesthetic reasons to break up the whiteness in the winter where possible. These general guidelines are discussed in Appendix D on page 3 of the ROW Plan.

The general procedures for clearing methods or for wildlife areas, wetland areas or areas near streams are described on page 11 of the ROW Plan. Any herbicide use is subject to obtaining a permit from the Vermont Agency of Agriculture, which typically contains specific instructions related to protecting the waters of the state, including required buffer zones near standing water, streams, ponds and lakes. (See Section 3.3.4 below for a description of wetland classification.)

Wildlife travel lanes are maintained in VELCO ROWs in appropriate locations in order to promote movements of white-tailed deer and other wildlife across the corridor. In general, the ROW-management objectives are to favor vegetation that can support snow (softwoods) and thereby keep the snow depth on the ground shallow enough for deer to move about and to conceal wildlife that cross wildlife-travel lanes.

VELCO disposes of the vegetation that is cleared by windrowing all trees at the edge of the ROW for the landowners' use. Stumps would be pulled in locations where structures or anchors would be installed. Limbs and brush would be chipped and spread on-site to help ground stabilization.

2.6.1(c) Access-Road Construction

Existing roads will be used as access to the line for men and equipment and for line-material delivery where possible. VELCO anticipates that some existing access roads may need minor upgrading, *e.g.*, grading and some crushed-rock reinforcing. New access roads require clearing, grading and may also require excavation or filling and the deposit of crushed rock on the surface.

Construction-staging areas along the route would be selected, to the extent possible, at existing cleared areas when the project is close to starting construction. Good examples of "ideal" construction-staging areas would be already paved or graveled sites, *e.g.*, utilizing a portion of the Pike Industrial area (see Sheet 2 of the Orthophotos (Appendix C)).

To control erosion at these areas, VELCO will require the contractor to develop an erosion-control plan that complies with the Vermont Handbook for Soil Erosion and Sediment Control of Construction Sites and to install and maintain control measures as specified in VELCO's erosion-control plan, the text of which may be found in Appendix D.

2.6.1(d) Pole Installation

The proposed line from Irasburg Substation to Mosher's Tap will require the excavation of holes for pole placement. The preferred corridor would be rebuilt approximately pole-for-pole along the alignment of the existing 48-kV line, except where impacts on wetlands would be minimized with selective placement of new poles. In alternative corridors, each pole placement would be new. The line will use a combination of guyed[13] and self-supporting wood, laminated-wood or Corten™ steel poles. (Refer to Figures 2-2 and 2-3 above.)

At Highgate, the new single-span tap line, from the 120kV line to Highgate Substation, would be constructed using wood H-frame structures (see Figure 2-4, referenced above). All re-routing of

[13] A "guy" is a cable used to support a pole or tower. This term is not specific to utility poles and transmission towers. Poles used in circus and picnic tents and towers that support weather stations and satellite transmitters might also use guy wires for support (Ref.: EnergyVortex.com).

lines required at Highgate Substation would be constructed utilizing single-pole, guyed-wood structures placed just outside the substation fence.

The installation of poles varies with the local surface geology. For areas overlain with soil and glacial deposits, excavation may require earth augers or backhoes. Areas with very dense glacial till and bedrock would most likely be excavated by means of drilling and blasting. The poles would be placed in the excavated holes and backfilled with excavated material or crushed stone that is tamped in place. Excess excavated material would be disposed on-site with regard for drainage and erosion considerations. No fill would be placed in wetlands.

For each tangent structure, it is anticipated that holes 3 to 4 feet in diameter would be excavated to a depth of 10 to 12 feet. The average spacing between poles would be approximately 400 feet except in the two sections where the 12.5-kV, distribution under-build has to be re-attached. In those two sections, spans would be approximately 330 feet.

2.6.1(e) Framing and Stringing

The pole would be framed on the ground with insulators, hardware, and running blocks, i.e., all of the attachments required would be attached to the pole on the ground while still horizontal. The poles would then be set as described in the previous section. Ropes long enough to be reached from the ground would be hung in each running block and hung up on the pole.

Once all poles are set, a pull ("p") line would be strung between splice/terminal locations. The rope in each running block would be used to pull the p-line up through the running block. This work would be performed by a six-wheeler truck, pickup, or a small track vehicle. The p-line would then be used to pull the conductor in between splice/terminal locations.

Once the conductor is in, it would be sagged (tension adjusted) according to the day's weather conditions. Pickups or six-wheeled trucks would then be used to return to the structure to remove the running block and transfer the conductor to a clamp that attaches to the insulator.

Once the transmission lines are installed, the electric-power distribution and phone lines would be transferred to the pole using new hardware. The existing lines would be reused, and aerial bucket trucks would be used for access to the lines.

Impacts on sensitive wetlands would be minimized either by working in the winter or working off commercial-construction "mats," a thick cover that is placed over the wetlands for a short period of time so that construction activity occurs on the mats and therefore does not come into contact with the underlying wet area. Silt fencing, stone-check dams, and other standard erosion-control methods would be used when necessary to minimize erosion.

2.6.2 Substations

VELCO will not be constructing new substations related to this project because of the cost and also because improving or consolidating existing substations minimizes impacts by locating facilities in already-disturbed, already-fenced sites that have access roads in place. Using an existing facility has the benefit of not causing any change to an already-established use of the land.

2.6.2(a) Irasburg and St. Johnsbury

No expansion of the fence yard or additional site grading and drainage at the existing St. Johnsbury and Irasburg Substations would be required. However, both sites would have expanded control buildings, and they would house sink and toilet facilities connected to new on-site septic facilities.

2.6.2(b) Highgate

As discussed previously, VELCO's Highgate Substation and VEC's Highgate Substation would be combined. Currently, the two substations are separated by approximately 120 feet and have separate ground grids and fences. To make room for the new 115-kV ring bus, the area between the two substations is needed. Therefore, one yard would be developed, with one ground grid, one control house, and one perimeter fence. This approach would eliminate one control house and the existing gate and driveway access to the existing VELCO substation. The former VEC Substation gate and access road would be used for the expanded and combined substation.

Additionally, VELCO will expand the substation to the west to make room for the associated capacitor banks and the future installation of synchronous condensers if VELCO determines they are necessary. The existing fenced area is 57,708 square feet (1.32 acres), and the new area would be 143,812 square feet (3.30 acres). The expanded area would have the organic material (typically up to the first 2 feet) removed. The area would then be cut or filled to rough grade. Fill would consist of a processed, well-draining, granular material. When ground work is complete, crushed stone would be used to get the yard up to finish grade. Final surveys would need to be complete before the amount of fill and grading could be determined.

2.6.2(c) St. Albans

The St. Albans Substation area would need to be surveyed before final construction requirements will be known. Based on an evaluation of the existing 115-kV transmission line's profile, cuts and fills will be necessary.

The existing surface slopes slightly downward heading north. A swale on the north side of the fenced yard would be carved out to route any water around the yard to the west side of the right-of-way. The site work would include cutting the off the area required for the yard and then leveling the yard with either existing subsurface material or additional material trucked in. The finish grade would consist of a permeable crushed stone that would not result in any run-off from the yard.

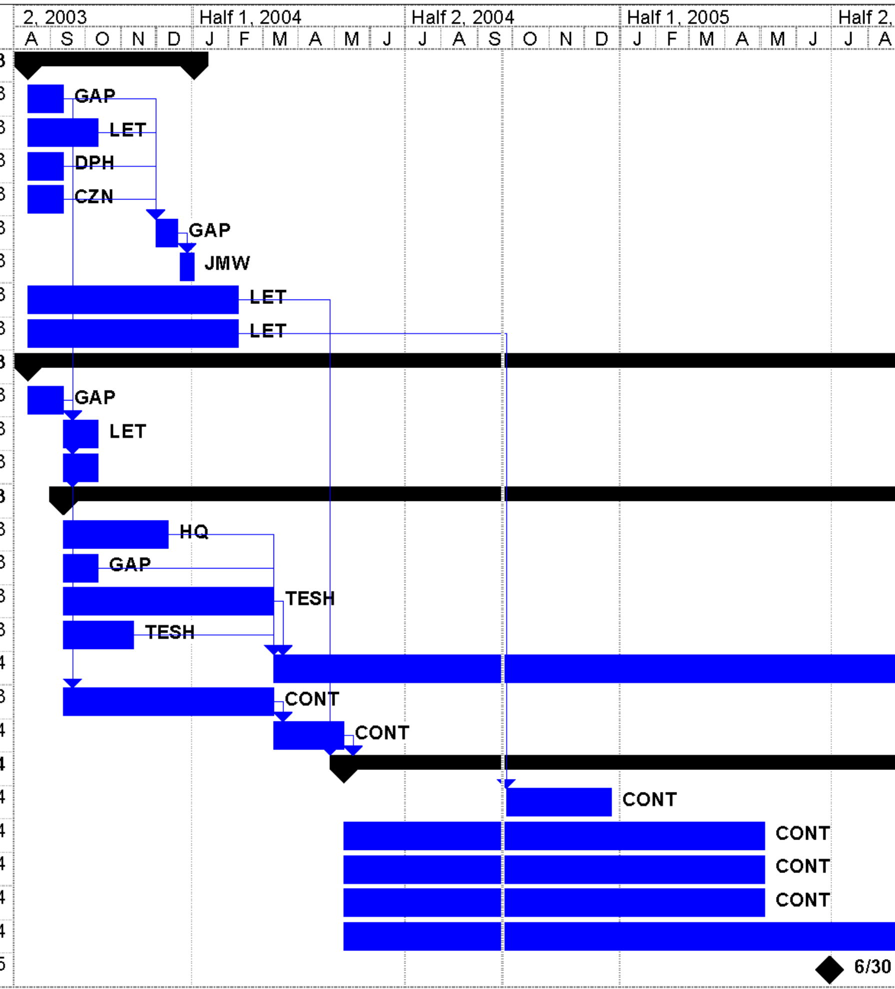
2.6.3 Schedule

The original schedule for the construction of the Northern Loop Project is shown in Figure 2-6 below but has slipped. Construction is now planned to start in the fall of 2004 with completion by the summer power period of 2005.

Northern Loop Project (NLP) Schedule

Tue 12/16/03 2:00 PM

ID	Task Name	Duration	Start
1	**Citizens Asset Purchase**	**102 days?**	**Thu 8/14/03**
2	PSB 109 approval	22 days?	Thu 8/14/03
3	Amend Derby Line PP	60 edays	Thu 8/14/03
4	Highgate Revenue Meter Upgrades	30 edays	Thu 8/14/03
5	Verify CZN easements	30 edays	Thu 8/14/03
6	Closing	15 days?	Mon 12/1/03
7	Secure CZN spare parts	10 days?	Mon 12/22/03
8	NLP PP amendments (Highgate/Derby)	180 edays	Thu 8/14/03
9	Procure remaining 11 Easements	180 edays	Thu 8/14/03
10	**Synchronous Condenser Options**	**552 days**	**Thu 8/14/03**
11	Decide Option A/C A= install, C= eliminate	30 edays	Thu 8/14/03
12	If Option C amend 248, delete tasks 14 - 19	30 edays	Sat 9/13/03
13	VDU transfer contract from Highgate to P1/2	30 edays	Sat 9/13/03
14	**If option A**	**530 days**	**Sat 9/13/03**
15	HQ facility study	90 edays	Sat 9/13/03
16	Formalize HQ/VELCO TTC MOU	30 edays	Sat 9/13/03
17	Design/procure SC equipment	180 edays	Sat 9/13/03
18	Converter/SC interaction evaluation	60 edays	Sat 9/13/03
19	Install/Commission SC	563 edays	Thu 3/11/04
20	NLP Engineering & Procurement specs/RFP	180 edays	Fri 9/12/03
21	Solicit/evaluate procurement/construction bids	60 edays	Wed 3/10/04
22	**NLP Construction/Commissioning**	**408 days**	**Sun 5/9/04**
23	M.Tap/Irasburg 115 line	90 edays	Sun 9/26/04
24	St. Johnsbury sub	360 edays	Sun 5/9/04
25	Irasburg Sub	360 edays	Sun 5/9/04
26	St. Albans Tap	360 edays	Sun 5/9/04
27	Highgate Substation	570 edays	Sun 5/9/04
28	Project Complete	0 days	Thu 6/30/05



Project: NLP construction schedule fig
Date: Tue 12/16/03

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary			

Figure 2-6